JMS-T2000GC AccuTOF™ GC-Alpha
Sensitivity in nitrogen carrier gas ② - EI / FI ion source

Related products: Mass spectrometer (MS)

Introduction

Due to the global shortage of helium gas supply, the demand for alternative gas for GC-MS carrier gas is increasing. Nitrogen gas is the most suitable gas due to its availability and high safety, but it is known that the influence of nitrogen ions generated by the MS ion source causes a decrease in sensitivity. So we have checked the influences of nitrogen carrier gas on JMS-T2000 GC AccuTOF ™ GC-Alpha, and report on MS Tips No. 374-376. This report shows the results of the EI (Electron Ionization) / FI (Field Ionization)combination ion source, which is one of the characteristic multi-ionization ion sources of JMS-T2000 GC AccuTOF ™ GC-Alpha.

Measurement

Table 1 shows the details of the measurement conditions in this experiment. In the EI method, 1 µL of OFN (octafluoronaphthalene) 100 pg / µL was injected. In the FI method, 1 µL of hexadecane 10 ng / µL was injected. Helium and nitrogen were used as carrier gases, and the S/N sensitivity, similarity to the library spectrum (M.F.), and mass accuracy (error) of molecular ions were compared. The carrier gas flow rate was set to 1.0 mL / min in helium and 0.55 mL / min in nitrogen based on the optimum linear velocity of each carrier gas. The ionization energy in the EI method was measured at 20 eV, which is expected to suppress the ionization of nitrogen, in addition to the general 70 eV.

Table 1. Measurement conditions

GC : 8890GC (Agilent Technologies, Inc.)		**TOFMS : JMS-T2000GC AccuTOF™ GC-Alpha**	
Injection volume	1 µL	Ion source	EI/FI combination ion source
Mode	Splitless	Ionization	①EI, ②FI
Column	DB-5MS UI	EI Ionization energy	70eV (300µA), 20eV (200µA)
	(Agilent Technologies, Inc.)	(filament current)	
	30m x 0.25mm, 0.25µm	Mass Range	*m/z* 35-600
Oven temperature	40°C(1min)-30°C/min	Detector voltage	2600V
	-250°C(2min)		
Carrier flow	He : 1.0 mL/min		
	N_2 : 0.55 mL/min		

Results ① EI method

Figure 1 shows the extracted ion chromatograms (*m/z* 272.98 ± 0.10) of the OFN measurement results in the EI method. The sensitivity was decreased about 1/3 in nitrogen (70 eV). Since the EI / FI shared ion source has an open structure without a chamber, nitrogen retention in the ion source is small. Therefore, it is considered that the influence of nitrogen ions was small and the sensitivity decrease was suppressed. In nitrogen (20eV), which was expected to suppress the sensitivity decrease, the sensitivity was further decreased. It was confirmed that it is not necessary to change the ionization energy in the EI / FI ion source.

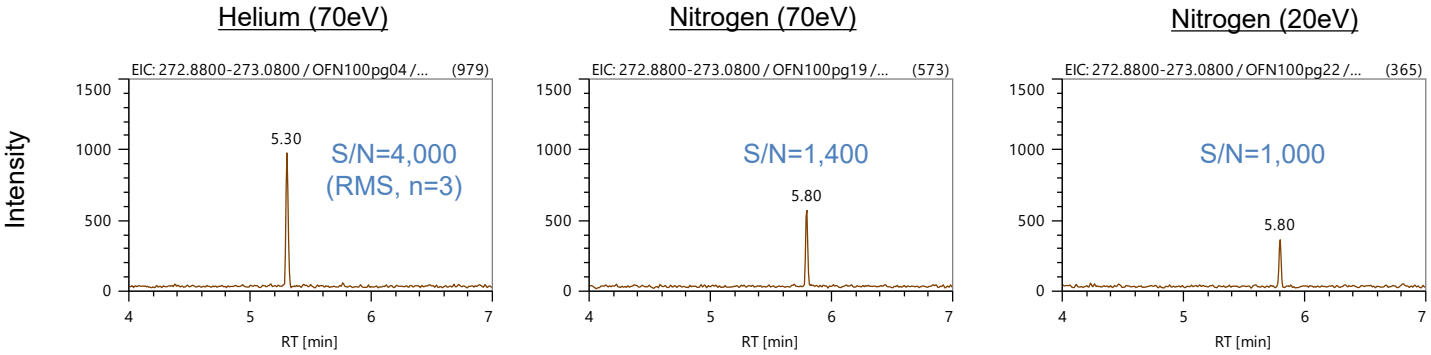

Figure 1. EICs of OFN（EI method)

Figure 2 shows the mass spectra of the OFN measurement results in the EI method. The similarities to the library spectra (M.F.) were good at 800 or more in helium (70eV) and nitrogen (70eV). It was decreased to about 590 in nitrogen (20eV)), since the low energy ionization suppressed the fragments and changed the spectrum. The mass error of the molecular ion $M^{+\cdot}$ (*m/z* 271.9867) was 1 mDa or less in helium (70 eV). They were decreased to 2 mDa or less in nitrogen (70 eV) and nitrogen (20 eV).

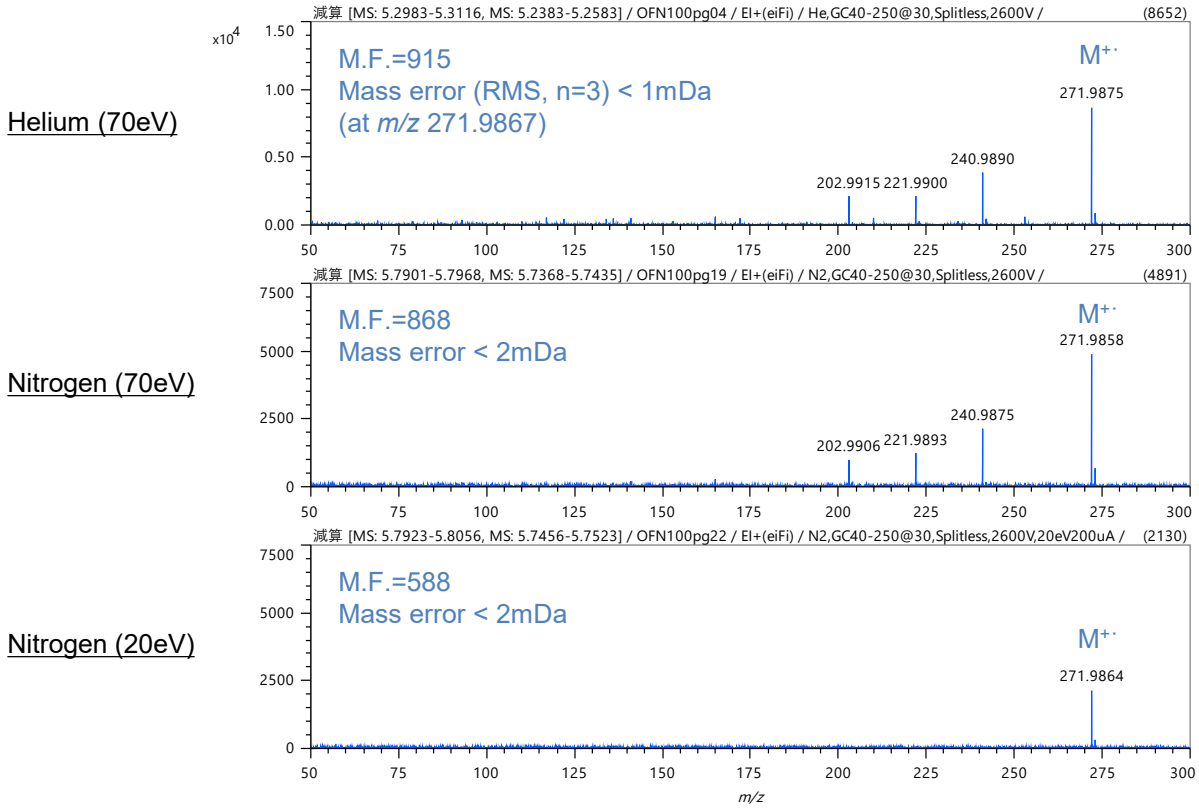

Figure 2. Mass spectra of OFN（EI method)

Results ② FI method

Figure 3 shows the extracted ion chromatograms (*m/z* 226.26 ± 0.10) of the hexadecane measurement result in the FI method. The sensitivity was almost the same in helium and nitrogen. Since nitrogen is hardly ionize in the FI method, which is soft ionization, the decrease in sensitivity was suppressed.

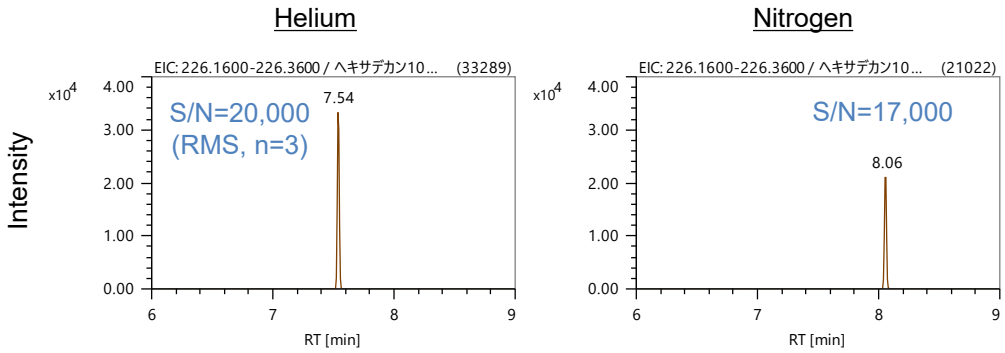

Figure 3. EICs of hexadecane（FI method)

Figure 4 shows the mass spectra of the hexadecane measurement results in the FI method. The mass error of the molecular ions $M^{+\cdot}$ (*m/z* 226.2655) were 2 mDa or less in both results.

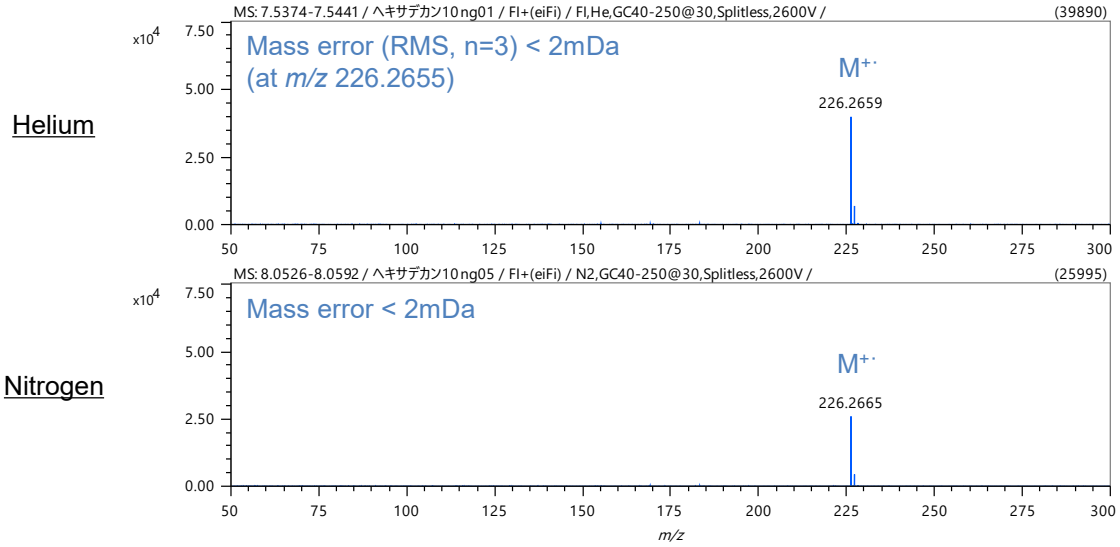

Figure 4. Mass spectra of hexadecane（FI method)

Conclusion

The influences of nitrogen carriers on the EI / FI combination ion source of JMS-T2000GC AccuTOF ™ GC-Alpha were checked. In the EI method, the sensitivity was decreased to about 1/3. In the FI method, the sensitivity was not decreased. The mass errors of the molecular ions were as good as 2 mDa or less in both EI method and FI method.

JEOL Ltd.
3-1-2 Musashino Akishima Tokyo 196-8558 Japan Sales Division Tel. +81-3-6262-3560 Fax. +81-3-6262-3577
www.jeol.com ISO 9001 • ISO 14001 Certified
▼ Local office
• AUSTRALIA & NEW ZEALAND • BELGIUM • BRAZIL • CANADA • CHINA • EGYPT • FRANCE • GERMANY • GREAT BRITAIN & IRELAND • ITALY • KOREA • MALAYSIA • MEXICO • RUSSIA • SCANDINAVIA • SINGAPORE • TAIWAN • THE NETHERLANDS • USA